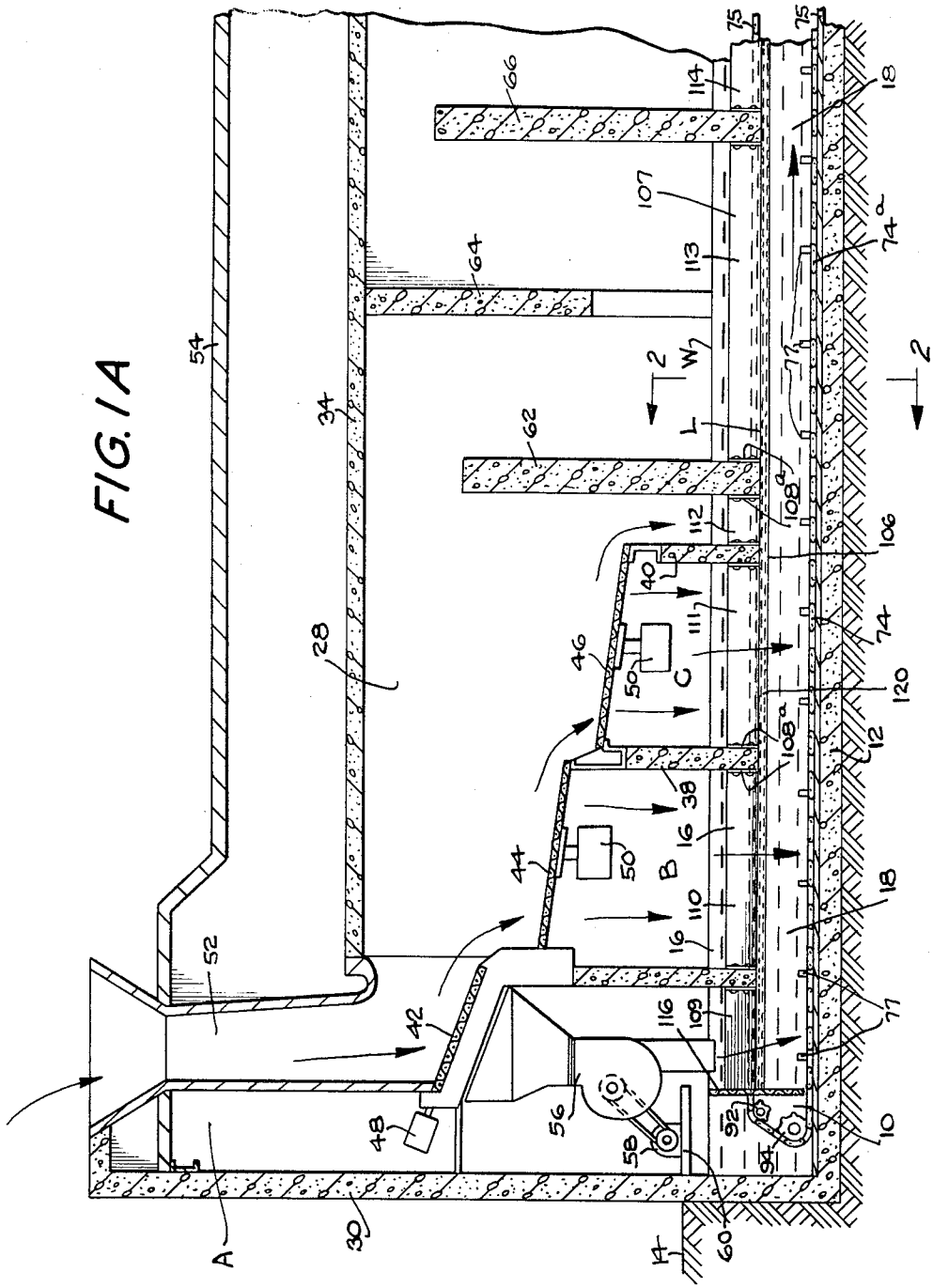
April 7, 1970 W. G. DAVENPORT 3,504,645

ENCLOSED CONVEYOR RETURN RUN FOR INCINERATORS

Filed Aug. 15, 1968 4 Sheets-Sheet 1

FIG. 1A



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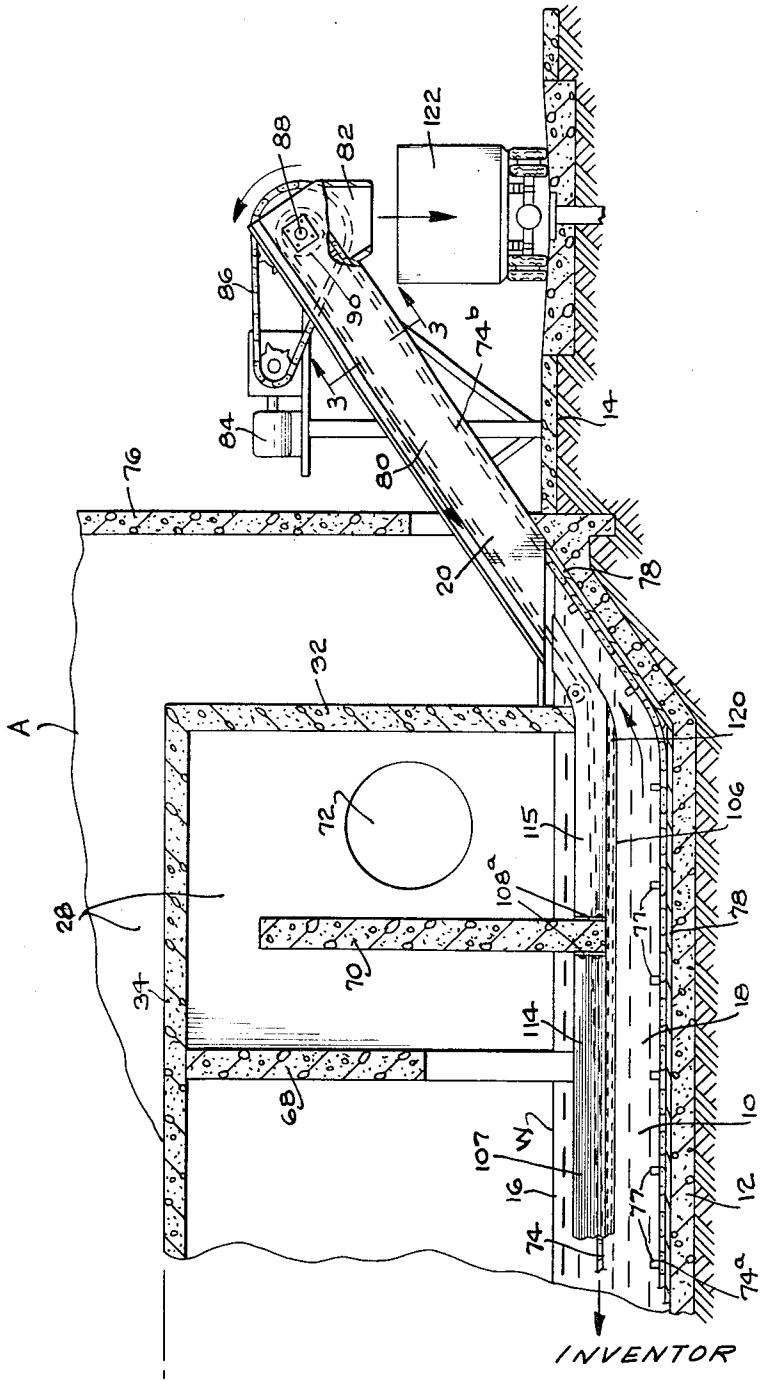
ATTORNEYS.

April 7, 1970 W. G. DAVENPORT 3,504,645

ENCLOSED CONVEYOR RETURN RUN FOR INCINERATORS

Filed Aug. 15, 1968 4 Sheets-Sheet 2

FIG. 1B



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April 7, 1970 W. G. DAVENPORT 3,504,645

ENCLOSED CONVEYOR RETURN RUN FOR INCINERATORS

Filed Aug. 15, 1968 4 Sheets-Sheet 3

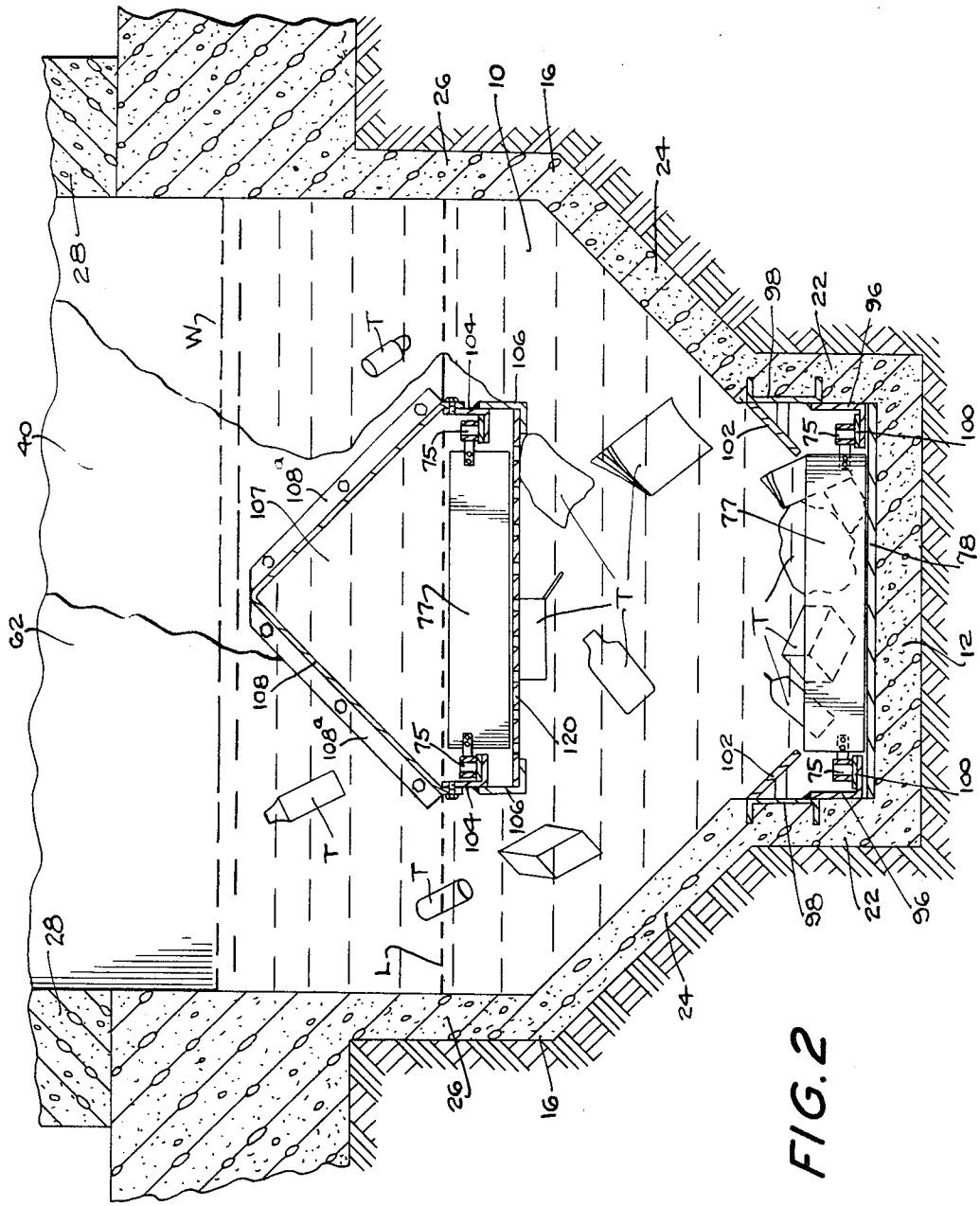


FIG. 2

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ENCLOSED CONVEYOR RETURN RUN FOR INCINERATORS

Filed Aug. 15, 1968 4 Sheets-Sheet 4

FIG. 3

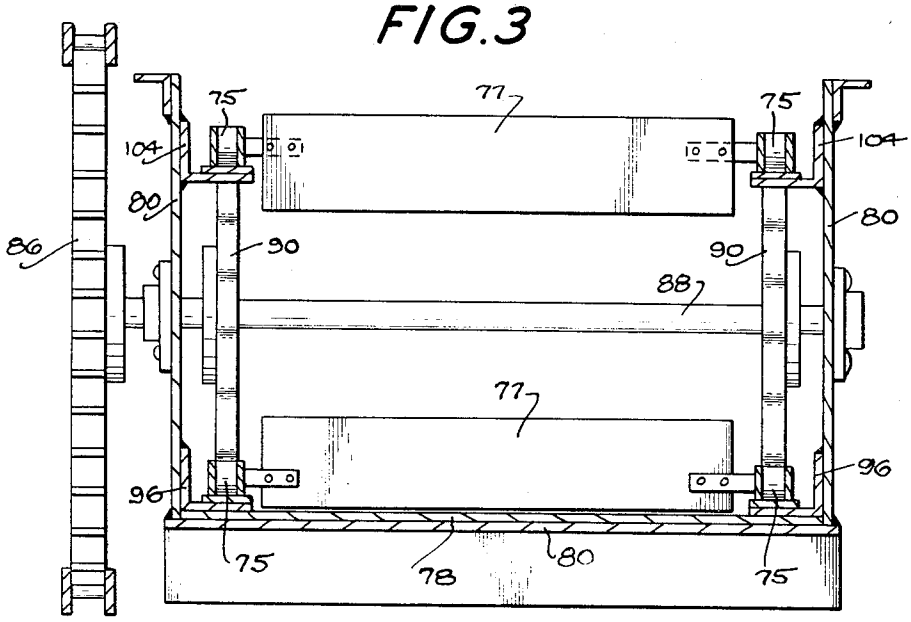


FIG. 4

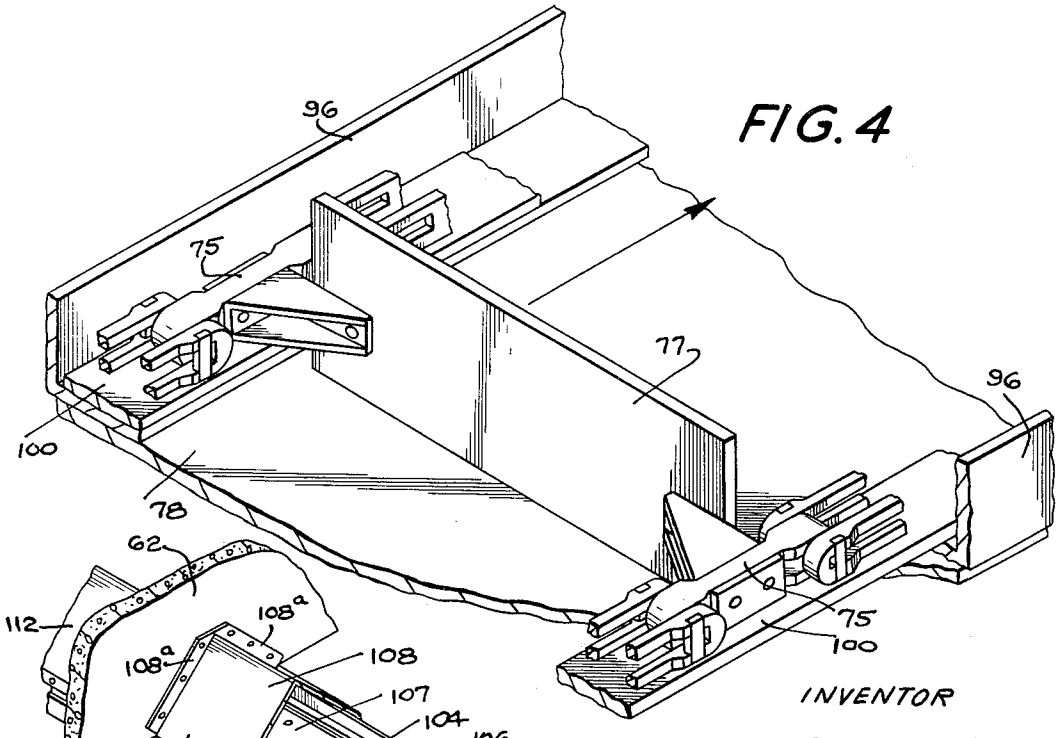


FIG. 5

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United States Patent Office 3,504,645
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3,504,645

ENCLOSED CONVEYOR RETURN RUN FOR INCINERATORS

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Int. Cl. F23g 3/00; F23j 1/06
U.S. Cl. 110—8 10 Claims

ABSTRACT OF THE DISCLOSURE

An incinerator having an underlying, below-grade trench filled with water within which is accommodated a flight conveyor having vertically spaced runs both submerged in the water, the lower ash-conveying run being disposed in the bottom of the trench to transfer ash and other residue of the material burned in the incinerator to a discharge station located externally of the incinerator beyond and above the far end of its said underlying water-filled conveyor trench, and the upper return run of the conveyor being housed within a casing which serves not only to deflect the burnt residue from entering the upper run as it is discharged from the combustion chamber of the incinerator into said water-filled trench but also to prevent any of said residue floating in the water to enter said upper return run.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates generally to incinerators and particularly to incinerators of the type used by municipalities, hospitals, and other large institutions which have need for large capacity units.

Description of the prior art

It is common practice for effecting discharge from incinerators of ash and other solid residues remaining after combustion of the refuse material has been completed in the incinerator to employ endless drag-type conveyors in which a pair of laterally spaced sprocket chains are connected by uniformly spaced transversely extending flights or scrapers which ride on a plate disposed beneath one or the other of the vertically spaced top and bottom runs of the conveyor. In some systems the return run of the conveyor extends over the top of the incinerator furnace from a debris discharge point located at a suitably elevated point beyond the confines of the incinerator, and thus require auxiliary mechanism for charging the furnace with refuse to be incinerated without interference by the conveyor extending across the top of the incinerator.

In other systems, specially designed inclined chutes are employed to effect discharge of the ash and other residue of combustion from the furnace chamber to the material handling lower run of the conveyor below the top return run thereof. These inclined chutes necessarily require considerably more head-room beneath the incinerator furnace grates than is normally available or desirable.

In still other systems, the conveyor extends lengthwise of the incinerator with its vertically spaced material-handling and return runs both disposed in a below-grade pit or trench, the material-handling run being topmost and fitted with a bottom plate along which the material is dragged by the flights of said topmost run to the point of its discharge.

It has also been proposed prior to the present invention that in the last-mentioned system the upper material-handling run of the conveyor be submerged in a water-filled trough so that the water therein may provide, in conjunction with suitable baffling means projecting below the water level, a seal to insure that the solid products of combustion do not pass into atmosphere with the flue gases under the influence of the draft induction fan or stack of the incinerator.

The problem with these prior systems, and particularly the last-mentioned system, it that where the return run of the conveyor is disposed in a below-grade pit or trench, it becomes necessary for the servicing of the conveyor to provide alongside of said trench a costly auxiliary concrete area-way having one or more openings in communication with the below-grade trench housing the return run of the conveyor to afford servicing access to said return run.

SUMMARY OF THE INVENTION

Contrary to common practice in the design of drag type conveyors for incinerators, the present invention has as its principal object the provision of a conveyor having both its top and bottom runs submerged in a water-filled trench with its bottom run dragging along the bottom of the trench to move the solid products of combustion out of the trench to their point of discharge and at the same time prevent any such accumulation of ash and other debris in the upper return run of the conveyor as might be carried by it toward the foot section of the conveyor and there cause the conveyor to become jammed.

To this end, the upper return run of the conveyor is enclosed within a casing having a top portion in the form of a hood having downwardly diverging members which serve to deflect the ash and other residue discharged from the incinerator furnace from entering the upper run of the conveyor and a bottom cover which serves to prevent any solid objects from floating upwardly in the trench water to become entangled between the flights of the conveyor return run.

The trench is made sufficiently wider than the conveyor at the level of the top run of the conveyor to provide adequate space between the sides of the conveyor and the embracing side walls of the trench for access to the conveyor for such servicing thereof as may be necessary. Also, in order to direct the products and residue of combustion onto the bottom run of the conveyor and to prevent lateral displacement of the debris collected thereon, the side walls of the trench below the level of the conveyor top run are inclined inwardly toward one another and then respectively extend vertically downward in close proximity to the opposite sides of the conveyor bottom run to provide a relatively narrow well along the bottom of which the conveyor bottom run flights move to drag the debris to the point of discharge thereof outside of the incinerator.

DESCRIPTION OF THE INVENTION

The foregoing and other objects of the present invention will appear more fully from the following description, it being understood that the invention consists substantially in the combination, construction, location and relative arrangement of parts as hereinafter described, as shown in the accompanying drawings and as finally pointed out in the appended claims.

In the accompanying drawings:

FIGURE 1A is a longitudinal section through one end of the incinerator showing the foot section of the residue flight conveyor submerged in the water-filled trench;

FIGURE 1B is a longitudinal section through the opposite end of the incinerator showing the load section of the residue flight conveyor emerging from the water and trench and extending to an unloading station;

FIGURE 2 is an enlarged transverse sectional view as taken along the line 2—2 of FIGURE 1*a*;

FIGURE 3 is an enlarged transverse section view as taken along the line 3—3 of FIGURE 1*b*;

FIGURE 4 is a perspective view of a fragment of the bottom working run of the residue flight conveyor; and

FIGURE 5 is a perspective view of a fragment of the top return run of the residue flight conveyor.

Referring now more particularly to the drawings, it will be observed that the incinerator designated A, which may be of any suitable type, is provided at the bottom thereof with a reinforced concrete trench **10** extending along the full length of the incinerator from front to rear thereof. The trench, which has a bottom wall **12** below grade **14** and opposite side walls **16**, includes a longitudinally extending main horizontal section **18** having an upwardly inclined rear section **20**. The opposite side walls of the trench each comprise a vertical lower section **22**, an upwardly and outwardly inclined intermediate section **24** and a vertical upper section **26**, the spacing of the trench side walls being such as to center it between the opposite side walls **28** of the incinerator combustion chamber, the front end of which is closed by a vertical transversely extending wall **30** and its rear end by a vertical transversely extending wall **32**. The top of the combustion chamber is closed by a horizontally extending wall **34** extending lengthwise of the incinerator at a height spaced substantially above the trench **10**. Disposed within the fore end of the combustion chamber are a plurality of longitudinally spaced transversely extending vertical cross beams **36**, **38** and **40** which support a plurality of inclined grates **42**, **44** and **46**, the first one of which is provided with a conventional vibrator **48** and the last two of which are each provided with a conventional burner and vibrator unit **50**. It will be noted that the several grates **42**, **44** and **46** are disposed in longitudinally spaced stepped relation to provide beneath the grates **44** and **46**, as shown, two separate combustion zones B and C. It will be understood, of course, that the number of grates and combustion zones may be increased as desired, as the size and length of the incinerator may require.

The top wall **34** of the incinerator combustion chamber, interiorly of its front wall **28** is fitted with a feed chute **52** which extends through the roof **54** of the incinerator and communicates with the first inclined grate **42** from which the material to be burnt passes on to the burner grates **44** and **46**. Underlying the grate **42** is a blower unit **56** also of conventional type, driven by an electric motor **58** carried by a bracket **60** extending from the wall **30**, for forcing the gases of combustion through the combustion chamber to the gas discharge stack at the rear of the incinerator.

Suitably arranged within the combustion chamber rearwardly of the furnace zones B and C thereof are a plurality of longitudinally spaced, transversely extending baffle members **62**, **64**, **66**, **68** and **70**. The baffle members **64** and **68**, disposed in intervening relation with respect to the members **62**, **66** and **70**, extend downardly from the top wall **34** of the combustion chamber to points spaced substantially above the level W of the water in the trench **10**, while the members **62**, **66** and **70** extend upwardly from a line L (see FIGURE 2) below the water level W in the trench to points spaced below the top wall **34** of the combustion chamber. The series of baffle members **62** to **70** thus provide a sinuous path of travel of the hot gases of combustion forced through the incinerator by the blower for discharge thereof through an opening **72** at the rear of the incinerator (FIGURE 1B) in communication with a gas discharge stack (not shown), it being noted in this regard that the baffle members **62**, **66** and **70** which have their lower ends submerged in the water of the trench act as seals to prevent any possible horizontal flow of the combustion gases along the surface level of the trench water directly to the gas exhaust stack.

If desired, the areas between the longitudinally spaced baffle members **62** to **70** may be provided with conventional water spray type scrubbers (not shown) which operate to wet down the solids and fly ash that might be entrained in the gas and cause the same to fall out of the gas stream and into the water trench for discharge by the drag conveyor operating in said trench.

Occupying the trench **10** and emerging therefrom at the discharge end of the incinerator is a residue flight conveyor, generally designated **74**, having a horizontally extending main section **74***a* fitted within the horizontal length of the trench **10** and an inclined rear section **74***b* extending outwardly and upwardly from the rear end thereof through an opening suitably provided in the rear wall **76** of the incinerator structure to a point well above the grade level. This conveyor **74** is of the endless chain type having a pair of laterally spaced sprocket chains **75**—**75** which carry therebetween a plurality of transversely extending flight or scrapers **77** spaced uniformly along the lengths of the chains.

Referring particularly to FIGURES 2 and 4, it will be noted that the flights **77** of the lower run of the conveyor **74** drag along the surface of a plate **78** which extends along the full length of the trench **10** as a bottom liner therefor and thence upwardly out of the rear end of the trench as a bottom liner of the inclined external section of the conveyor, which external section is suitably enclosed within a housing **80** having a discharge chute **82** at its outer end.

The conveyor, with its main horizontal section completely submerged in the water-filled trench, is suitably driven by a motor **84** through a chain and sprocket drive **86** operatively connected to the shaft **88** of a pair of head sprockets **90** about which are entrained the opposite side chains **75**—**75** of the conveyor. These sprocket chains are also trained over vertically spaced pairs of sprockets **92** and **94** suitably journalled in the water-filled trench at the extreme forward end thereof. The direction of travel of the conveyor is as indicated by the arrows in FIGURE 1B, the lower run of the conveyor moving rearwardly toward its discharge end with the flights thereof dragging along the bottom of the water trench.

As is best shown in FIGURES 2 and 4, the conveyor sprocket chains moving along the lower or working run of the conveyor are supported upon a pair of laterally spaced angle iron tracks **96**—**96** which are secured to and depend from channel members **98**—**98** fixed in the inner surfaces of the trench side wall sections **22**—**22**. Preferably, the tracks **96**—**96** are respectively provided with wear strips **100**—**100** which underlie the chains as the same move along their tracks. The track-supporting channel members **98**—**98** also support at opposite sides of the water trench **10** deflector plates **102**—**102** which respectively serve as inward extensions of the oppositely inclined intermediate sections of the trench side walls not only to direct the debris which falls into the trench out of the combustion chamber onto the central portion of the lower working run of the conveyor, but to prevent the debris and refuse from the combustion chamber landing upon and fouling the sprocket chains.

Along the upper or return run of the conveyor the sprocket chains thereof are supported upon and guided in their travel by a pair of laterally spaced angle iron tracks **104**—**104** respectively disposed in spaced, horizontal relation to the conveyor lower run tracks **96**—**96**, these upper level tracks being mounted upon supports **106**—**106** extending lengthwise of the conveyor and secured in position by any suitable means. As in the case of the lower run chain guide tracks the upper set of tracks are also faced with wear strips for the sprocket chains **75**—**75**.

Referring again to FIGURES 1A, 1B and 2, it will be observed that the upper run of the main horizontal section **74** of the conveyor operating within the water trench **10** is protected against entry thereinto of debris and residue discharged through and from the grates **64** and **68** of the incinerator by an enclosure **107** having a top hood

108 of inverted V-shape in transverse section. This hood 108 is made up of a plurality of longitudinally alined similar sections 109, 110, 111, 112, 113, 114, and 115, each being flanged at its opposite ends, as at 108*a* for rigid securement to the lower end portions of all of the transversely extending members 36, 38, 40, 62, 64, 66, 68 and 70 which project below the level of the water in the trench 10, which water level is designated W in FIGURES 1A, 1B and 2. It will be noted that the peak or ridge of this hood 108 is located just below the water level W and that the opposite downwardly diverging sides of the hood deflect the residue discharged from the combustion chamber and the particles thereof floating in the water away from the upper run of the conveyor and toward the opposite side walls of the trench for eventual deposit upon the lower run of the conveyor and conveyance thereby to the discharge end thereof.

The extreme fore and aft ends of the sectionalized hood 108 are respectively suitably secured to and supported by a perforated plate or screen 116 extending transversely across the front end of the trench and by the rear wall 32 of the combustion chamber. The screen 116 is suitably apertured to provide for free travel of the upper or return flights of the conveyor about the front end sprockets thereof. The bottom edges of the hood 108 are disposed in the common horizontal plane of the lower edges of the transversely extending cross beams 36, 38 and 40 of the combustion chamber and the transversely extending baffle walls 62, 64, 66, 68 and 70 spaced rearwardly of the cross beams.

Supported by and between the supports 106—106 for the guide tracks 104—104 of the return run of the conveyor sprocket chains is a horizontally disposed bottom cover plate 120 in closely spaced underlying relation to the flights 77 of the return run of the conveyor submerged in the water of the trench 10. This cover plate which preferably is in the form of an expanded metal screen serves, conjointly with the inverted V-shaped hood 108, to provide the enclosure designated 107 for the full length of that portion of the return run of the conveyor which moves through the water in the trench and thus provides an effective means for preventing debris T floating in the water from entering into and accumulating in the return run of the conveyor. The oppositely diverging sloping sides of the hood portion 108 of the enclosure 107 serve to deflect the unburned residues and ash discharged from the combustion chamber to either side of the return run of the conveyor for deposit in the water trench and removal therefrom by the lower working run of the drag conveyor. It will be appreciated, of course, that the bottom screen 120 of the enclosure 107 may be replaced, if desired, by an imperforate metal plate since the enclosure is not sealed against the entry thereinto of the trench water. Any suitable means (not shown) may be provided for effecting continuous circulation of water through the trench 10 and for maintaining the water at a predetermined constant level adequate to insure complete submergence of both the upper and lower runs of the conveyor in the water of the trench.

In the operation of the incinerator, trash fed into the chute 52 passes downwardly through the chute under the influence of gravity and is deposited successively upon the grates 42, 44 and 46 which, upon vibration, keep the trash being burnt in the furnace moving towards the baffle 62. The major portion of the trash burns and disintegrates sufficiently to cause the residue to pass through the grates to be finally dropped into the trench water, while the larger noncombustible particles of the trash move to the rear end of the grate assembly from which they fall into the trench. At the same time the air-entrained products of combustion, as wetted down by scrubbers operating in the aft regions of the combustion chamber, also fall into the trench water to eventually settle down upon and be dragged out of the water-filled trench by the lower working run of the drag conveyor. The unburnt trash and residue passing through and off of the furnace grates 44 and 46 by-pass the fully enclosed upper return run of the drag conveyor in consequence of which there is no possibility for any of the trash floating in the trench water to enter into the upper return run of the conveyor and cause it to be jammed by accumulation of the trash at the foot or forward end of the conveyor. Instead, the trash is deposited solely upon the lower working run of the conveyor to be dragged thereby along the bottom of the trench and thence outwardly thereof along the bottom of the inclined external section of the conveyor for discharge through the chute 82 into a loading truck 122 or other device for moving the residue away from the incinerator.

It will be noted that when the trench is drained, the upper return run of the flight conveyor is easily accessible for effecting repairs thereto and that the lower working run of the flight conveyor is also easily accessible for effecting repairs thereto without any necessity for disturbing the upper return of the flight conveyor. Access is had from either side thereto through the spaces between the sloping intermediate sections 24 of the walls 20 and the upper working run of the flight conveyor.

The present invention is applicable to various constructions of incinerator plants such as those, for example, wherein the incinerator plant is provided with a single, or two or more furnaces disposed in side by side relation, extending across the width of the incinerator, each said furnace being provided with its own stoker, e.g., a grate equipped with a conventional burner. These grates sometimes referred to as stokers, receive the material to be incinerated and discharge the burnt material off of the rear or discharge ends thereof, just as the burnt material is discharged from the grate 46 of the incinerator shown in the drawings. The burnt residue discharged from the stoker drops into a region which extends transversely across the combustion chamber and, in accordance with the principles of the present invention, this region may be fitted with a water-submerged endless drag-type conveyor similar to that shown in the drawings, but which extends crosswise to the incinerator combustion chamber rather than lengthwise thereof.

As in the arrangement illustrated, both of the upper and lower runs of the conveyor running cross-wise of the incinerator combustion chamber are submerged in a water-filled trench with the upper run housed within an enclosure having a top section of inverted V-shape and a bottom section in the form of a screen. Where the incinerator plant is thus equipped with a water-submerged drag conveyor running cross-wise of the furnace, the material discharged from the furnace stoker drops into the water trench in which the conveyor is mounted wherein it is engaged by the flights of the bottom run of the conveyor and dragged by the same to an elevated point of discharge located at one side or the other of the incinerator plant externally thereof. The material discharged from the stokers is precluded from engagement with the flights of the upper run of the conveyor, exactly as in the case of the longitudinally extending conveyor of the system as illustrated, and thus the return run flights of the conveyor are maintained free and clear of debris which, by accumulation thereof at the foot or return end of the conveyor, might cause it to become jammed.

In this last-described arrangement wherein the water-submerged conveyor extends transversely rather than longitudinally of the incinerator, the water-filled trench which contains the drag conveyor is so disposed beneath the furnace grate or stoker that the discharge therefrom may drop directly into the trench and therein be engaged by the flights of the bottom run of the conveyor which scrape along the bottom of the trench to drag the stoker discharge out of the incinerator plant.

The material of smaller particle size which passes downwardly through the openings in the furnace grates simultaneously as the larger size particles drop off the discharge ends of the grate must also be directed into the water-

filled trench and where it may be economically not feasible to provide a trench of a width sufficient to underlie the full longitudinal extent of the stoker or grate so as to receive all of the discharge therefrom, whether it be through the grate openings or off its rear end, each grate may be provided therebeneath with an auxiliary conveyor running lengthwise thereof at a suitable level for receiving the stoker discharge and delivering it into the water-filled trench to therein be engaged by the bottom run flights of the water-submerged drag conveyor.

It will be understood that various other changes and modifications of the present invention may be made without departing from the general principles or the real spirit thereof and it is accordingly intended to claim the same broadly as well as specifically, as indicated in the appended claims.

What is claimed as new and useful is:

1. In an incinerator apparatus having a combustion chamber and grate means for moving trash to be incinerated into and through said chamber, in combination, an elongated trench spaced below said grate means to receive the burnt material discharged from said grate means, said trench being filled with water to a substantially constant level, an endless drag conveyor having a pair of laterally spaced chains which support therebetween a plurality of longitudinally spaced material-dragging flights, the material-moving and return runs of said conveyor being both completely submerged in the water of the trench with the flights of the material-moving run dragging along the bottom of the trench for removal of material which falls into the trench from said combustion chamber, and means enclosing the water-submerged return run of the conveyor flights to maintain the same free of any accumulation of debris deposited from the combustion chamber into the water-filled trench.

2. In an incinerator apparatus as defined in claim **1** wherein said last-mentioned means includes a hood of inverted V-shape in transverse section extending lengthwise along the top of and in vertically spaced covering relation to the upper run of said drag conveyor submerged in said water-filled trench, the opposite sides of said hood diverging downwardly at opposite sides of said upper run of the conveyor for deflecting therefrom material falling out of the combustion chamber into said trench.

3. In an incinerator apparatus as defined in claim **1** wherein said last-mentioned means includes a bottom member closely underlying said upper run of the flight conveyor in said water-filled trench to preclude upward entry into said upper run of material floating in said water-filled trench.

4. In an incinerator apparatus as defined in claim **3** wherein said bottom member consists of a perforated plate.

5. In an incinerator apparatus as defined in claim **1** wherein said trench is provided with opposite side walls having upper sections each spaced a substantial distance outwardly from the corresponding side of the upper run of the conveyor in the trench, said upper sections of the side walls of the trench having depending portions which respectively slope downwardly below the upper run of the conveyor and inwardly toward the longitudinal center line of the conveyor for directing fall-out material from the combustion chamber toward and onto the lower material-dragging run of the conveyor.

6. In an incinerator apparatus as defined in claim **5** wherein said inwardly sloping side wall sections of the trench terminate in downwardly extending vertical wall sections which closely embrace therebetween the lower material-dragging run of the conveyor.

7. In an incinerator apparatus as defined in claim **6** wherein said inwardly sloping side wall sections of the trench are respectively provided with laterally spaced downwardly inclined deflector plates in extension of said sloping side walls and disposed in spaced overlying relation to the opposite chains of the conveyor to prevent deposit of material on said chains.

8. In an incinerator apparatus as defined in claim **1** wherein said trench extends lengthwise from front to rear of said combustion chamber in underlying relation to said grate means and said combustion chamber is provided with a plurality of longitudinally spaced, transversely extending, parallel baffie members which are arranged with their lower edges alternately submerged in and spaced above the water in said trench, the upper edges of the baffie members having their lower edges submerged being spaced from the top wall of the combustion chamber and the upper edges of the baffie members having their lower edges spaced above the water being in engagement with the top wall of the combustion chamber, whereby to provide in said combustion chamber rearwardly of the grate section thereof a sinuous path of travel for the combustion gases to the discharge stack of the incinerator.

9. In an incinerator apparatus as defined in claim **8** wherein said apparatus is further characterised by the provision in said combustion chamber of a plurality of transversely extending, longitudinally spaced grate-supporting members having their lower edges submerged in the water of said trench, and wherein said means enclosing the water-submerged return run of the conveyor flights comprises a longitudinally extending hood overlying said return run, said hood including a plurality of longitudinally alined sections which respectively extend between and are supported by the water-submerged lower portions of said grate-supporting members and said combustion gas baffie members.

10. In an incinerator as defined in claim **8** wherein the combustion chamber is provided with a rear wall extending downwardly below the level of the trench water to seal off the gases of combustion in said chamber, and wherein said conveyor operating in said trench is extended rearwardly beyond said rear wall of the combustion chamber and upwardly above the water line in the trench to an elevated point external of the combustion chamber for discharge at said point of the material dragged out of the trench by the material-dragging run of the conveyor.

References Cited

UNITED STATES PATENTS

2,983,234	5/1961	Reilly	110—165 XR
3,133,804	5/1964	Hardgrove	110—165 XR

KENNETH W. SPRAGUE, Primary Examiner

U.S. Cl. X.R.

110—165